Newtownabbey Borough Council

Environmental Services Department

Second & Third Stage
Review and Assessment
of Local Air Quality

August 2004

Newtownabbey
BOROUGH COUNCIL

C O N T E N T S

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PART SIX – REVIEW AND ASSESSMENT OF PARTICLES

APPENDICES

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PART ONE - INTRODUCTION

1.1 The Legislative Background

This is the combined Second and Third Stage Review and Assessment technical report for Newtownabbey Borough Council which assists with the local air quality management duties as specified in Part III of the Environment (Northern Ireland) Order 2002.

The First Stage report dated March 2001 identified which of the National Air Quality Strategy (NAQS) objectives were likely to be exceeded as well as identifying localities of concern for each pollutant which should be the focus of a Second Stage Review and Assessment.

The overall purpose of the Review and Assessment is to enable local authorities to appraise current and future air quality for their geographical area against the objectives of the Air Quality Regulations (Northern Ireland) 2003.

Within Northern Ireland the review and assessment process is currently following a three stage phased approach. The first stage completed on a voluntary basis by all Councils in Northern Ireland involved an initial screening of industrial, transport and other sources of pollutants which may have had a significant impact within an authority's area.

The second stage involves the estimation, modelling and monitoring of the identified pollutants. The third stage involves a detailed and accurate appraisal of the potential impacts of the pollutants including monitoring, modelling and emission inventories.

The recommendations from the Stage 1 Review and Assessment report indicated that there was a risk of exceeding the NAQS objectives by 2005 for the following pollutants:

- Carbon monoxide (CO)
- Lead (Pb)
- Nitrogen dioxide (NO_2)
- Sulphur dioxide (SO_2)
- Particulate matter (PM_{10})

The aim of the Second/Third Stage report is therefore to provide a further screening of these pollutants only by detailed assessment.

1.2 Objectives of the Air Quality Regulations (Northern Ireland) 2003

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured As	
Benzene	16.25 μgm^{-3}	Running annual mean	31.12.2003
	3.25 μgm^{-3}	Running annual Mean	31.12.2010
1,3 Butadiene	2.25 $\mu g/m^{-3}$	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mgm^{-3}	Maximum daily running 8-hour mean	31.12.2003
Lead	0.5 μgm^{-3}	Annual mean	31.12.2004
	0.25 μgm^{-3}	Annual mean	31.12.2008
Nitrogen dioxide [1]	200 μgm^{-3} not to be exceeded more than 24 times a year	1 hour mean	31.12.2005
	40 μgm^{-3}	annual mean	31.12.2005
Particles (PM_{10}) (gravimetric) [2]	50 μgm^{-3} not to be exceeded more that 35 times a year	24 mean	31.12.2004
	40μgm^{-3}	Annual mean	31.12.2004
Sulphur Dioxide	350 μgm^{-3} not to be exceeded more than 24 times a year	1 hour mean	31.12.2004
	125 μgm^{-3} not to be exceeded more than 3 times a year	24 hour mean	31.12.2004
	266 μgm^{-3} not to be exceeded more than 35 times a year	15 minute mean	31.12.2005

1. The objectives for nitrogen oxide are provisional

2. Measured using European gravimetric transfer standard or equivalent

1.3 The Administrative Area of Newtownabbey Borough Council

Newtownabbey is situated on the shore of Belfast Lough reaching north from the City of Belfast and stretching up towards the Glens of Antrim. The Council area is 54 square miles and is bound to the west by Antrim Borough Council, to the north by Larne Borough Council, to the east by Carrickfergus Borough Council and to the south by Belfast City Council.

Newtownabbey Borough Council has a population of approximately 80,000 and is the fifth highest Borough population within Northern Ireland.

The majority of the population of the Borough is in the developed urban area stretching out from Glengormley to include Whiteabbey, Mossley, Monkstown and Mallusk and Ballyclare. There are a number of rural villages including Ballynure, Ballyrobert, Ballyeaston, Doagh and Straid, all of which lie within the commuter belt of Belfast.

The Borough is a prime business location with large industrial centres at Mallusk, Hydepark and Monkstown. Newtownabbey's proximity to Northern Ireland's ports and airports makes these industrial parks an ideal place to locate. The port of Larne, Belfast International Airport and Belfast City Airport are within 30 minutes drive and the area is also well served by major roads linking it to the rest of the province. The Borough is well provided for in terms of major retail outlets and shopping centres at Abbeycentre and Northcott.

PART TWO - REVIEW AND ASSESSMENT OF CARBON MONOXIDE

2.1 Introduction

When undertaking this review and assessment the focus has been on the likely exceedances of the objective for carbon monoxide at those locations where the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective.

The Air Quality Objective for carbon monoxide is measured as a maximum daily running 8 hour mean and the locations to be considered include building facades of residential properties, schools, hospitals and libraries etc. and the gardens of residential properties where there are seating or play areas.

The Government and Devolved Administrations have adopted a maximum daily running 8 hour mean of 10 mgm^{-3} to be achieved by 31 December, 2003. This objective is equivalent to that set in the second Air Quality Daughter Directive.

2.2 Sources of Carbon Monoxide

The main source of carbon monoxide in the UK is road transport which accounted for 67% of total releases in 2000. Annual emissions of carbon monoxide have been falling steadily since the 1970s and are expected to continue to do so.

2.3 First Stage Review and Assessment

2.3.1 Industrial Sources

The First Stage Review and Assessment document highlighted one Part A industrial process within Belfast City Council's (a neighbouring Council) area which was potentially a significant source of carbon monoxide, namely:

DoE Waste Sludge Incinerator, Duncrue Road, Belfast

2.4 Second Stage Review and Assessment

2.4.1 Industrial Sources

The Belfast sewage sludge incinerator is located within the Belfast Waste Water Treatments Works, Duncrue Road, Belfast and is approximately 3 km from the boundary with Newtownabbey Borough Council. The incinerator has been operational since March 1999, is designed to burn 24,000 tonnes of dry sewage sludge per annum and has a stack height of 70m. It is authorized under Article 6 of The Industrial Pollution Control (NI) Order 1997.

As part of their Second Stage Review and Assessment of carbon monoxide (*Belfast City Council Second and Third Stages of the National Air Quality Review and Assessment Process, April 2004*), Belfast City Council assessed the incinerator by obtaining information from the Department of Regional Development and considering the air quality impact assessment forming part of the application for Industrial Pollution Control authorisation.

Technical guidance LAQM.TG (03) does not provide screening tools for the evaluation of industrial source carbon monoxide emissions. Using the tools provided in the Pollution Specific Guidance LAQM.TG4 (00), Belfast City Council concluded for a stack height of 70m, the incinerator would have to emit approximately 6000 tonnes per annum to produce a maximum daily running 8hr mean ground level concentration of 1.16 mgm^{-3}, whereas the annual emissions of carbon monoxide from the incinerator are significantly lower, at 0.055 tonnes per annum.

In addition, modelling undertaken as part of the Air Quality Impact Assessment forming part of the application for Industrial Pollution Control Authorisation for the incinerator indicates that the carbon monoxide 1 hour maximum ground level concentration would increase by 2.3 μgm^{-3} as a result of the incinerator operation.

Having considered this Belfast City Council concluded that, given the background concentrations in the vicinity of the incinerator range from 0.27mgm^{-3} to 0.3 mgm^{-3} in 2003, it was unlikely that the 10.0mgm^{-3} maximum daily running 8 hour mean objective would be exceeded.

2.5 Conclusion

It is therefore not necessary to proceed to the Third Stage of the Review and Assessment for carbon monoxide within Newtownabbey from Belfast Sewage Sludge and it will not be necessary to declare an Air Quality Management Area in Newtownabbey for carbon monoxide.

PART THREE – REVIEW AND ASSESSMENT OF LEAD

3.1 Introduction

When undertaking this review and assessment the focus has been on the likely exceedances of the objective for lead at those locations where the public is likely to be regularly present and is likely to be exposed over the averaging period of the objective.

The Air Quality Objective for lead is measured as an annual mean and the locations to be considered include building facades of residential properties, schools, hospitals and libraries etc.

The Government and Devolved Administrations have adopted an annual mean concentration of 0.5 μgm^{-3} to be achieved by the end of 2004 and a lower objective of 0.25 μgm^{-3} to be achieved by the end of 2008. The 0.5 μgm^{-3} annual mean objective is equivalent to that set by the European Community in the 1st Daughter Directive 1999/30/EC.

3.2 Sources of Lead

The agreement between the European Parliament and the Environment Council on the Directive on the Quality of Petrol and Diesel Fuels has led to the ban on sales of leaded petrol in the UK from 1 January, 2000. Emissions of lead are now restricted to a variety of industrial activities, such as battery manufacture, pigments in paints and glazes, alloys, radiation shielding, tank lining and piping.

3.3 First Stage Review and Assessment

3.3.1 Industrial Sources

The First Stage Review and Assessment document highlighted one Part A industrial process within the Borough which was potentially a significant source of lead, namely:

Brett Martin Limited, 24 Roughfort Road, Mallusk

3.4 Second Stage Review and Assessment

3.4.1 Industrial Sources

Brett Martin Limited manufactures plastic products mainly for the building industry. There are three types of products manufactured in which lead is a component:

- Pipe production by extrusion
- Injection moulding of pipe fittings
- Freelite sheet production by extrusion

The Brett Martin site has two emission points which are checked for lead on annual basis. The 2003 emission test reports for these emission points were reviewed with the Industrial Pollution Inspectorate. The first emission point test report (June 2003) shows a lead concentration of <0.001 mg. With a sample volume of 0.174 m^3 per hour this gives a concentration of 0.0057 mgm^3. This is the concentration from the discharge of the bag filter. By the time the discharge reaches the boundary of the operation the concentration will have been reduced to well below the Air Quality limit of 0.5 mg/m^3. The mixing of lead only takes place for 10 minutes every hour so for the other 50 minutes the exhaust is just clean air.

The second emission point test report (July 2003) shows that no lead was detected.

3.5 Conclusion

It is therefore not necessary to proceed to the Third Stage of the Review and Assessment process for lead from Brett Martin Limited and it will not be necessary to declare an Air Quality Management Area in Newtownabbey for lead.

PART FOUR – REVIEW AND ASSESSMENT OF NITROGEN DIOXIDE

4.1 Introduction

When undertaking this review and assessment the focus has been on the likely exceedances of the objective for nitrogen dioxide at those outdoor locations where the public is likely to be regularly present and is likely to be exposed over the averaging period of the objective.

The Air Quality Objective for nitrogen dioxide is measured as an annual mean and a 1 hour mean and the locations to be considered include building facades of residential properties, schools, hospitals, libraries etc, gardens of residential properties, kerbside sites (eg busy streets) and any outdoor locations where the public might reasonably be expected to spend 1 hour or longer.

The Government and Devolved Administrations have adopted a maximum annual mean concentration of 40μgm^{-3} and a 1 hour mean concentration of 200 μgm^{-3} not to be exceeded more than 18 times per year. Both objectives are to be met by the end of 2005.

4.2 Sources of Nitrogen Dioxide

Nitrogen dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen and are collectively referred to as nitrogen oxides (NO_x). All combustion processes produce NO_x emissions, largely in the form of nitric oxide, which is then converted to nitrogen dioxide, mainly as a result of reaction with ozone in the atmosphere. It is nitrogen dioxide that is associated with adverse effects upon human health.

The principal source of nitrogen oxides emissions is road transport which accounted for about 49% of total UK emissions in 2000.

The contribution of road transport to nitrogen oxides emissions has declined significantly in recent years as a result of various policy measures and further reductions are expected up until 2010 and beyond.

4.3 First Stage Review and Assessment

4.3.1 Roads and Junctions

Roads and junctions were identified at First Stage in line with Guidance LAQM TG4 (00).

Two nomograms for a single carriageway road and a dual carriageway road or a motorway as per the guidance were used to determine the relationship between daily mean traffic flow, average traffic speed and 2005 background NO_X and the risk of exceeding the objective for nitrogen dioxide.

Using this method:

- at least 13 sections of single carriageway roads,
- 4 dual carriageway/motorways,
- 37 junctions

were predicted to exceed the projected annual average daily traffic flow thresholds.

4.3.2 Planned Developments

Six planned developments within the Newtownabbey area were also identified with the potential to increase traffic flows by 2005.

4.3.3 Monitoring of NO_x and NO_2

Prior to the First Stage Review and Assessment 5 x NO_2 diffusion tubes were located throughout the Borough (see **Table 1, Appendix 1**).

4.4 Second Stage Review and Assessment

4.4.1 Roads and Junctions

The annual mean NO_X concentration for 2005 at 42 kerbside locations in the Borough was estimated by Netcen using the Design Manual for Road Bridges (DMRB) 1999 (Air Quality Review and Assessment Stage 2, May 2002, Netcen). Technical Guidance LAQM.TG (03) indicates that DMRB can be used as a screening assessment for road traffic sources. The DMRB includes a simple methodology for estimating the concentrations of pollutants in the vicinity of roads and requires annual average traffic flow, annual average speed, fraction of heavy duty vehicles and the distance from the road to receptor in order to calculate these concentrations. Subsequent conversion of NO_2 is undertaken using empirical methods.

Traffic flows calculated at the First Stage Review and Assessment were used and the effect of junctions was taken into account. Traffic speeds of 32 kph at road junctions, 48 kph on free flowing roads in the urban area and 80 kph on motorways were used. The distance from the receptor to the centre of the road and from the receptor to the kerb of the road were estimated by Netcen from maps provided by the Council. The percentage of heavy duty vehicles was estimated by DRD Roads Service as 7.3%. Netcen used a conservative background NO_X concentration of 32.1 μgm^{-3} in the assessment. Where exceedances of the objective were predicted the use of the estimated background for that particular location was used in the modelling process.

Table 2 in Appendix 1 gives the results of the DMRB (2002) assessment for the 42 kerbside locations and indicated that 15 kerbside locations were predicted to exceed the 2005 NAQS annual mean objective for NO2 (ie 40 μgm^{-3}). The locations are listed in the following table.

Description of Link	Distance to nearest receptor from kerbside (m)	NO_2 Annual mean (μgm^{-3}) 2005	NO_2 99.8th percentile of hourly averages (μgm^{-3}) 2005
Shore Rd South of Jordanstown Rd	4.4	45.0	157.6
Mallusk Rd West of Scullions Rd	5.0	47.0	164.5
Doagh Rd at Kings Rd	10.0	41.4	145.0
South of Sandyknowes	11.3	47.0	167.6
Shore Rd/Jordanstown Rd junction	17.5	50.6	177.3
O'Neill Rd/Doagh Rd junction	20	42.8	149.8
A8 Mossley Junction	8.5	47.5	166.3
Mallusk Rd/Bernice Rd junction	3	50.3	176.0
Monkstown Rd/Doagh Rd junction	5	50.2	175.8
Ballynure Rd/Templepatrick Rd junction	9.5	41.6	145.6
Manse Rd/Prince Charles Way junction	13.8	40.6	141.9
Shore Rd/Longwood Rd junction	6.25	52.2	182.6
Monkstown Rd/Old Carrick Rd junction	3	41.1	143.9
Ballynure Rd/B58 junction	5	41.1	143.7
Hightown Rd/Mallusk Rd junction	7.5	51.3	179.5

Following this assessment further traffic data was obtained from DRD Roads Service *(Air Quality Assessment Traffic Data Collection February 2003)* which included further information on flows, turning counts, speeds and percentage heavy duty vehicles.

This new traffic data was used by Netcen to carry out a further estimation of the annual mean NO_X concentration for 2005 using the new version of the DMRB (released in February 2003). The 15 receptors identified in the DMRB (2002) assessment together with one further receptor were reassessed *(Revised DMRB Assessment, April 2003 Netcen)*. Junctions were assessed in accordance with Interim Guidance Note 46/02 from the Highways Agency. Background NO_x and NO_2 concentrations for 2005 for the 1 km grid squares in which each location occurred were taken from the maps at www.airquality.co.uk

Table 3, Appendix 1 summarises the input data used in the assessment.

The results of the DMRB (2003) assessment for the 16 locations are shown below.

Receptor	**Annual Average Nitrogen Dioxide (μgm^{-3})**
Shore Road South of Jordanstown	31
Mallusk Road West of Scullions Road	37
Doagh Road at Kings Road	36
Longwood Road/Shore Road junction	**44***
South of Sandyknowes on dual carriageway	35
Shore Road/Jordanstown junction	35
Doagh Road/O'Neill Road junction	36
A8 Mossley	36
Mallusk Road/Bernice Road junction	**41***
Monkstown Road/Doagh Road junction	34
Ballynure Road/Templepatrick Road junction	37
Manse Road/Prince Charles Way	35

Monkstown Road/Old Carrick Road junction	36
Ballynure Road/B58	29
Hightown Road/Mallusk Road junction	32
Antrim Road	29

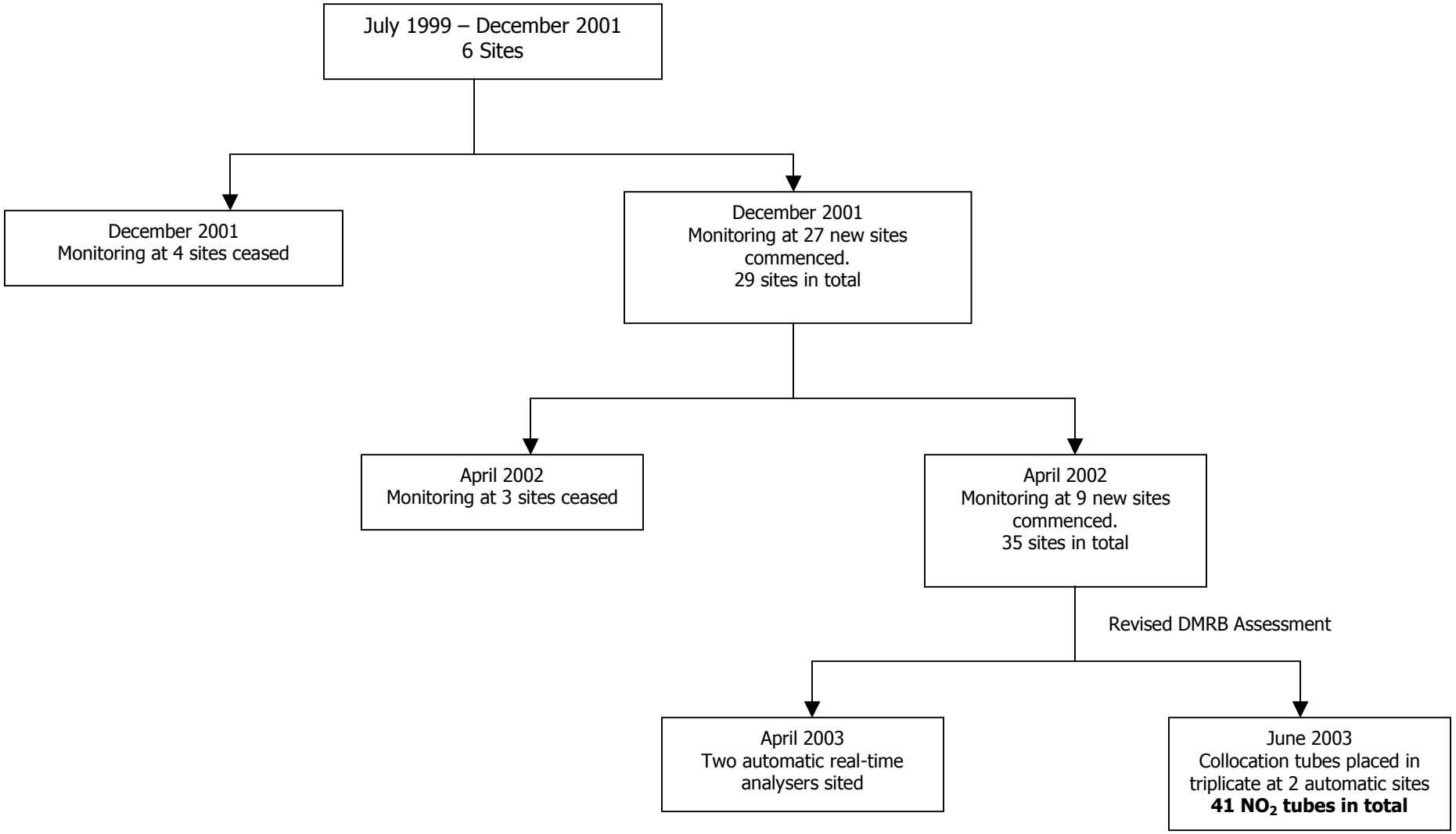
*** Predicted exceedance of the air quality objective of 40 µgm^{-3}**

4.4.2 Monitoring of NO_X and NO_2

Monitoring has an important role in Review and Assessment as it can provide information on current concentrations. It forms a reliable basis for estimating levels in 2005 which can then be compared to Air Quality Objectives.

There are a number of ways to measure NO_2 concentrations but the methods employed by Newtownabbey Borough Council for the Second/Third stage Review and Assessment process were passive diffusion tube monitoring and automatic monitoring. This monitoring regime is in line with a typical strategy as suggested by Technical Guidance LAQM TG (03). A summary of NO_2 monitoring undertaken as part of the Review and Assessment process within the Borough is shown below.

NO_2 Monitoring in Newtownabbey
July 1999 to June 2003



4.4.2.1 Passive Monitoring

Diffusion tubes provide an integrated, average concentration for the pollutant over a particular exposure period and are useful in providing an assessment against annual mean objectives. The tubes can be distributed to offer a wide coverage of an area at a relatively low cost. Diffusion tubes are less useful where greater spatial resolution is required for particular objectives.

The tube remains at a particular location for a four-week exposure time and when analysed in a laboratory, an average monthly concentration can be calculated.

In December 2001 as a result of the First Stage Review and Assessment Report monitoring at four of the existing NO_2 diffusion tubes was ceased as the tubes were deemed to be in the wrong location. Monitoring at 27 new locations commenced in December 2001 (see **Table 4, Appendix 1**). These sites were selected based on the roads and junctions identified at First Stage and on local knowledge.

Following the 2002 DMRB Assessment in April 2002 monitoring at three of the locations ceased. Two were deemed to be in the wrong location and one was subject to vandalism.

Monitoring commenced in April 2002 at 9 new locations, 35 monitoring locations in total (**Table 5, Appendix 1**).

In June 2003 tubes were placed in triplicate at the two automatic monitoring sites (41 tubes in total).

After the four week exposure the tubes were sent to Lambeth Scientific Services Limited, London for analysis and to calculate the average NO_2 concentration at each location.

Lambeth Scientific Services Ltd participate in the laboratory intercomparision exercises for the UK National NO_2 diffusion tube network.

4.4.2.2 Automatic Monitoring

The Stage 3 Review and Assessment requires the accurate measurement of NO_2 concentrations.

From April 2003 the automatic monitoring of NO_2 was undertaken at two locations in the Borough using chemiluminescent analysers. The analysers are sited at:

Location	**Grid Reference**
Antrim Road (Mallusk)	305 830
Shore Road	348 804

shown on the following maps:

Mallusk NO_2 Analyser Site

Shore Road NO_2 Analyser Site

The Shore Road analyser is located near one of the two receptors predicted by the revised DMRB assessment (2003) to exceed the annual average NO_2 concentration in 2005. It was not possible to site the other analyser adjacent to the second receptor and instead, based on local knowledge, the analyser was located adjacent to the Sandyknowes roundabout, one of the busiest roundabouts in Northern Ireland.

4.5 Third Stage Review and Assessment

4.5.1 Monitoring of NO_X and NO_2

4.5.1.1 Passive Monitoring

The diffusion tube results for 2003 are listed below (where tube missing and zero result recorded, average taken for number of tubes present):

	Location	No of tubes averaged	Average
1	Main Street, Ballyclare	12	34
2	Burnthill Road	11	26
3	St Bernard School, Antrim Road	12	27
4	Hightown/Mallusk Rd junction	12	26
5	McMillan House, Antrim Road	11	31
6	Greenacres, Glebe Road	11	21
7	Valley Leisure Centre	12	26
8	Braden Heights, Rathcoole	12	17
9	Merville Garden Village	12	24
10	M5 at Shore Road	12	32
11	44 Sandyknowes Avenue	7	38
12	Tudor Park, Mallusk	12	16
13	Scullions Road, Mallusk	12	29
14	Bottom Main Street, Ballyclare	11	20
15	North End, Ballyclare	12	19
16	Doagh Village	12	19
17	The Longshot, Doagh	12	17
18	Main Street, Ballynure	12	22
19	A8/Doagh Road	7	21
20	A8/Motorway at Sandyknowes	11	32
21	Ballyclare Road/Manse Road	9	33
22	Nortel	12	21
23	Opposite 189 Doagh Road	12	22

24	O'Neill Road/Doagh Road	12	20
25	Station Road	11	26
26	690 Shore Road	12	20
27	Opposite 1A Jordanstown Road	9	25
28	Jordanstown Road	10	19
29	174 Monkstown Road	11	16
30	Hillhead Road/Mill Road roundabout	10	23
31	Bernice Road/Mallusk Road	12	15
32	Antrim Road (Sandyknowes)	12	26
33	Manse Rd/Prince Charles Way r'bout	11	24
34	Old Carrick Road (Oaklands)	12	17
35	Henryville Court, Ballyclare	12	17
36	NO_X analyser, Antrim Road	7	17
37	NO_X analyser, Antrim Road	7	24
38	NO_X analyser, Antrim Road	7	24
39	NO_X analyser, Shore Road	7	21
40	NO_X analyser, Shore Road	6	25
41	NO_X analyser, Shore Road	7	25

All of the sites were located between the road traffic source and sensitive locations.

The 3 sites with the highest average nitrogen dioxide concentrations (based on the actual numbers of months' monitoring) were:

Site	**Locations**	**No of Months Monitoring**	**Annual Average**
Site 11	44 Sandyknowes Ave	7	38
Site 1	Main St, Ballyclare	12	34
Site 21	Ballyclare Rd, Manse Rd	9	33

Both sites 11 and 21 however were based on less than 12 months' monitoring (due to vandalism or a missing tube).

Advice was sought from the Review and Assessment Helpdesk and in order to obtain an estimation of the annual mean nitrogen dioxide concentration at both these sites an adjustment was made to the monitoring results as per Box 6.5 page 6 – 8 of the Technical Guidance LAQM TG (03).

The annual mean and period means were obtained for the neighbouring Belfast AURN site. The ratio of the annual mean to the average period mean was calculated. This was then used as the adjustment factor to estimate the annual mean short-term nitrogen dioxide concentration at sites 11 and 21. The calculations for sites 11 and 21 are shown in **Table 6, Appendix 1** and summarised below.

	Adjusted Annual Average
Site 11 (44 Sandyknowes Ave)	34.2
Site 21 (Ballyclare Road/Manse Road)	33.3

Bias Adjustment Factor

Results from diffusion tube collocation studies have shown there is considerable difference in the performance of passive diffusion tubes prepared by different laboratories. It is therefore necessary to apply a bias adjustment factor to diffusion tube monitoring results which is based on the collocation of tubes with a chemiluminescent monitor.

Two chemiluminescent NO_X monitors have been situated in Newtownabbey since April 2003 and triplicate diffusion tubes have been collocated at both the analysers since June 2003 (7 months for 2003). As a minimum, however, a bias adjustment factor based on a co-location study should be based on 9 months' data. Therefore advice was sought from the Air Quality Monitoring Helpline and a local bias adjustment factor was calculated as follows.

The University of the West of England's spreadsheets (published by Air Quality Consultants Limited on behalf of DEFRA, www.uwe.ac.uk/aqm/review) were used to obtain bias adjustment factors for other local authorities using Lambeth Scientific Services.

1. 2003 – Bias Adjustment factors from spreadsheet

   a) Derry CC 1.06
   b) East Hertfordshire DC 1.04

2. 2003 – NBC Analysers 7 months

   a) Mallusk 1.36
   b) Shore Road 1.23

$$\text{Average} = \frac{1.06 + 1.04 + 1.36 + 1.23}{4}$$

$$= \mathbf{1.17}$$

An average bias adjustment factor of 1.17 was then applied to the annual mean nitrogen dioxide concentrations at sites 11, 1 and 21 as shown below.

Bias Adjusted Nitrogen Dioxide Diffusion Tubes 2003 Concentrations (μgm^{-3})

	No. of Tubes	Annual Average	Adjusted Annual Average Box 6.5 TG(03)	Bias Adjustment Factor x 1.17
Site 11 44 Sandyknowes Ave	7	38	34.2	40
Site 1 Ballyclare	12	34	34	39.78
Site 21 Ballyclare Road/Manse Road	9	33	33.3	38.96

These bias adjusted concentrations were then corrected to estimate the annual average NO_2 concentrations in 2005 as per box 6.6 page 6-9 of the Technical Guidance TG (03).

2003 correction factor	0.941
2005 correction factor	0.892
2005 mean average NO_2 conc =	2003 annual average x (0.892/0.941)
	2003 annual average x 0.948

A summary of the annual average, the annual adjusted average, the bias adjustment factor and the estimated annual average NO_2 concentration for 2005 for site 11, 1 and 21 are shown below.

Nitrogen Dioxide Diffusion Tubes 2003 Concentrations (µgm^{-3}) Bias Adjusted and Corrected to 2005 Concentration

	No. of Tubes	Annual Average	Adjusted Annual Average Box 6.5 TG(03)	Bias Adjustment Factor x 1.17	Box 6.6 TG(03) Corrected to 2005 conc, 2003 measured conc x bias adjustment x (0.892/0.941) = 0.948
Site 11 44 Sandyknowes Ave	7	38	34.2	40	37.92
Site 1 Ballyclare	12	34	34	39.78	37.71
Site 21 Ballyclare Road/Manse Road	9	33	33.3	38.96	36.93

4.5.1.2 Automatic Monitoring

The stations contain automatic real-time analysers that produce high resolution measurements (inc. 15 minute averages). The measurements can be directly compared with the objectives.

The pollutant measured at both the stations is oxides of nitrogen.

The equipment works by generating a chemiluminescent reaction with ozone. By measuring NO_X and NO, NO_2 can be calculated. This method of monitoring has a higher accuracy (detectable concentration of 0.1 ppb) than diffusion tube monitoring.

Ideally when considering the annual NO_X objective a 12-month collection period is required with 90% data capture. If this is not possible then 6 months of consecutive summer and winter data is acceptable LAQM.

A service and maintenance agreement is in place covering the monitoring stations. Should the analysers malfunction an engineer is called out immediately to minimise data loss. Every 6 months a service is carried out which checks and reviews the entire system and its operation. The stations are visited regularly and the filters are changed every 2 weeks.

The NO_X analysers carry out daily auto-calibration procedures to check the analysis response. The auto-calibrations provide accurate zero and span response value. The calibration can be run normally in what is termed a two point calibration. The process requires cylinders with a known concentration of the pollutant to be run through the analyser. This is completed every two weeks.

Raw data from the monitoring stations is transmitted via modems to a computer in the Environmental Services Department of Newtownabbey Borough Council. The computer package used to store and manipulate the data is called Opsis Enview designed by ET. A QA/QC contract with NPL (National Physiological Laboratories) also covered the two analysers from April 2003 – March 2004. Weekly reports are received from NPL. Six-monthly QA/QC visits are made by NPL and ratified data was received from them on a six-monthly basis. Since April 2004 a 3 year QA/QC contract with Netcen covers the two analysers. Daily reports are received and six monthly QA/QC visits are made. The data quality reports by NPL for the 2 sites from 2 April 2003 to 31 March 2004 are shown in

Appendix 1. The mean nitrogen dioxide concentrations throughout the measurement period (2 April 2003 to 31 March 2004) are shown below:

Site	Mean NO_2 Concentration μgm^{-3}	Maximum Hourly Average μgm^{-3}
Antrim Road, Mallusk	31.8	190
Shore Road	29.8	159

4.6 Conclusion

The estimated 2005 annual average NO_2 concentrations for all the passive monitoring sites including sites 11 (44 Sandyknowes Ave), 1 (Ballyclare) and 21 (Ballyclare Road/Manse Road) are all below the Annual Mean Air Quality objective of 40 μgm^{-3}. As all of these sites were located between the road traffic and sensitive locations we have confidence that if these sites did not exceed the objective it will not be exceeded at the sensitive locations.

The mean nitrogen dioxide concentrations for the period (April 2003 to March 2004) at both the automatic monitoring sites are also below the Annual Mean Air Quality Objective of 40 μgm^{-3}. It will therefore not be necessary to declare an Air Quality Management Area in Newtownabbey for Nitrogen Dioxide.

4.7 Recommendation

In the case of site 11 at Mallusk a bus lane is currently being constructed on the hard shoulder of the motorway on-slip (see map below) and is due to become operational in September/October 2004. DRD Roads Service has advised the bus lane will operate daily from 7.30 am to 9.30 am with approximately 4-5 buses using the lane per hour. There are also proposals to widen the citybound carriageway of the M2 Motorway between Sandyknowes and Greencastle. Advice has been sought from the Review and Assessment Helpdesk and although it is not necessary to declare Air Quality Management areas in Newtownabbey for nitrogen dioxide it is recommended the diffusion tubes at sites 11, 1 and 21 be kept under review. Automatic monitoring of NO_2 will continue at Antrim Road, Mallusk and Shore Road.

PART FIVE - REVIEW AND ASSESSMENT OF SULPHUR DIOXIDE

5.1 Introduction

When undertaking this review and assessment the focus has been on the likely exceedances of the objective for sulphur dioxide at those locations where the public is likely to be regularly present and is likely to be exposed over the averaging period of the objective.

The Air Quality objective for sulphur dioxide is measured as a 15 minute mean and the locations to be considered include gardens of residential properties, pavements of busy streets and all locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.

The Government and Devolved Administration have adopted a 15 minute mean of 266 μgm^{-3} (not to be exceeded more than 35 times a year), a 1 hour mean objective of 350 μgm^{-3} (not to be exceeded more than 24 times per year) and a 24 hour objective of 350 μgm^{-3} (not to be exceeded more than 3 times per year). The 1 and 24 hour mean objectives are to be achieved by 31 December 2004 and the 15 minute mean objective to be achieved by 31 December 2005. The hourly and 24 hour objective are equivalent to the EU Stage 1 Unit values in the first Air Quality Directive.

5.2 Sources of Sulphur Dioxide

The main source of sulphur dioxide in the UK is power stations, which accounted for more than 71% of emissions in 2000. There are also significant emissions from other industrial combustion sources.

Domestic sources now only account for 4% of emissions, but local exceedances of the objectives may occur in areas where solid fuels are the predominant form of domestic heating.

5.3 First Stage Review and Assessment

5.3.1 Domestic Sources

At least four 1x1 km squares within Newtownabbey Borough Council were identified at first stage to have potentially more than 300 households burning coal (as per Technical Guidance LAQM TG 4(00)) and there was a risk of the 2005 objective for sulphur dioxide being exceeded for residential coal burning. (See **Table 1, Appendix 2**). The four squares identified were Ballyclare, Carnmoney, Mossley and Rathcoole.

5.3.2 Monitoring

Since August 1999 ambient sulphur dioxide concentrations have been monitored within the Borough by 2 non-automatic 8-port bubblers.

5.4 Second Stage Review and Assessment

5.4.1 Domestic Sources

Fuel use surveys were carried out in ten 1 x 1 Km squares within the Borough between February 2002 and November 2003. The % of properties surveyed in each square varied from 19 – 54%. Seven of the squares were surveyed by NBC staff and three were surveyed by Price Waterhouse Coopers on behalf of the Council.

The following table shows the areas surveyed, the total number of properties in the square, the percentage and number of properties surveyed and the total number of coal burning properties in the square.

Fuel Use Surveys

Square	Date of Survey	Total No of properties in 1 x 1 km sq	No of properties surveyed and % of total	Total no of predicted coal burning in square	Surveyed by
Ballyclare	February 2002	1350	322 (25%)	635	NBC Staff
Carnmoney	February 2002	1954	384 (20%)	381	NBC Staff
Glengormley 1	February 2002	1500	375 (25%)	240	PWC
Jordanstown	February 2002	1500	375 (25%)	255	PWC
Monkstown	February 2002	1500	375 (25%)	510	PWC
Mossley/ Carnmoney	February 2002	1954	375 (19%)	352	NBC Staff
Whiteabbey	February 2002	1954	375 (19%)	274	NBC Staff
Glengormley 2	February 2002	1500	375 (25%)	195	NBC Staff
Doagh	February 2002	700	375 (54%)	217	NBC Staff
Mossley	November 2003	1500	380 (25%)	330	NBC Staff

The survey was designed to assess domestic fuel usage and comprised 7 main sections:

- Fuel used for main heating
- Fuel used for back up or occasional heating
- Type of solid fuel appliances
- Type of solid fuel
- How often solid fuel appliances are lit
- Quantities of coal and oil used
- Any plans to change heating in the next 3 years

For the surveys conducted in February 2003 and November 2003, additional data was collected on the type of smokeless fuel used.

Face to face interviews were undertaken with heads of households or spouses. A summary of the main findings from the main surveys are shown next.

Summary of Findings from Fuel Use Surveys

Square	Fuel used for main heating			Back up heating %	% use coal as back up	Total quantities of coal burned Kg	
	% oil	% coal	% gas /other			Winter	Summer
Ballyclare	68	22	10	45	26	9424.75	2725
Carnmoney	89	7	4	35	13	4168.85	950
Glengormley 1	85	8	7	30	8	4300	1575
Jordanstown	73	4	21	40	13	3250	975
Monkstown	66	26	8	30	8	10975	4400
Mossley/ Carnmoney	87	4	9	39	14	3675	375
Whiteabbey	83	5	12	24	9	3256.25	550
Glengormley 2	96	2	2	34	11	1600	550
Doagh	63	13	24	29	18	6968.75	1400
Mossley	76	15	9	26	7	5575	1275

5.4.2 Monitoring

5.4.2.1 Eight-Port Bubblers

Following the Council's First Stage Review and Assessment (2002) the 8-port bubblers were relocated within 2 of the 1 x 1 km squares, identified as potentially having more than 300 households burning coal.

The locations of the bubblers are shown on the following maps:

Mossley

Ballyclare

The bubblers measure both sulphur dioxide and fine suspended particulate (as black smoke) over 24 hour periods. The sampler draws ambient air at a controlled and metered rate, first through a filter paper on which suspended particulate is collected, then through an acified solution of hydrogen peroxide in which sulphur dioxide is absorbed.

The amount of acid absorbed in the exposed peroxide solutions is determined by titration, with a standard alkaline solution. All data from the 8-port bubblers is subject to both quality assurance and control by AEA Technology (Netcen).

Eight-port bubblers can still be used to monitor sulphur dioxide as per the Technical Guidance LAQM.TG (03). The technique provides measurements of daily mean sulphur dioxide concentrations which can be directly compared to the 24 hour mean objective. For comparison with the 15 minute and 1 hour objectives, correction factors based upon measured maximum daily mean are provided. (Box 7.3 LAQM.TG (03))

5.4.2.2 SO_2 Diffusion Tubes

Ten SO_2 diffusion tube samplers were located throughout the Borough since December 2001 and a further tube was located in April 2003 (**Table 2, Appendix 2**). Technical Guidance LAQM TG (03) however does not recommend these are used for review and assessment. The samplers are only able to measure concentrations over a relatively long averaging period (4 weeks) which cannot be easily compared with the shorter term objectives. Use of the SO_2 diffusion tube samplers ceased in June 2004. The results from the tubes are given in **Table 3, Appendix 2**.

5.5 Third Stage Review and Assessment

5.5.1 Domestic Sources

Following the fuel use surveys four of the 1 x 1 km squares which were predicted to have more than 300 coal-burning properties within the square were modelled by Netcen (Air Quality Review and Assessment, Stage 3, Domestic Fuel Combustion, May 2004, Appendix 3). The modelling results predict that there will not be an exceedance of the 15 mean SO_2 objective in any of the survey areas in Newtownabbey. This is the most stringent SO_2 objective and so it is likely that the hourly and daily SO_2 objectives will also be met.
However, available data on the usage of solid fuel as a secondary source was not used in the modelling and Netcen have stated if the modelling were redone, accounting for these secondary data concentrations of SO_2 are likely to be elevated in the Ballyclare area and therefore possibly an exceedance for this pollutant may be identified.

5.5.2 Monitoring

Once re-sited at both locations the bubblers appeared to be affected by alkalinity from the following sources:

Bubbler	**Source of Alkalinity**
The Glade, Mossley	Adjacent slurry spreading
Mossvale Park, Ballyclare	Sewage works/cement works

Following discussion with Environment and Heritage Service, 6 months' ion chromatography analysis (from November 2003 – May 2004) was completed on the bubbler solutions by Harwell Scientifics Ltd. The results from Harwell were reported as total µg SO_2 as Sulphur per sample. Advice was sought from Netcen and the following formula was used to calculate the ambient sulphur dioxide in the samples.

C = 2cv/A

Where c = SO_2 – 5

v = the volume of solution

A = the actual sampled volume of air that went through the bubbler per 24 hour period (m^3).

The results of the ion chromatography are shown in **Table 4, Appendix 2**, all of which are well below the NAQ objective.

5.6 Conclusion

It will not be necessary to declare an Air Quality Management Area in Newtownabbey for sulphur dioxide at present.

5.7 Recommendation

As available data on the usage of solid fuel as a secondary source was not used in the initial modelling and there is a possibility if the modelling was re-done (taking account of these secondary data concentrations of SO_2) of an exceedance for this pollutant, it is recommended that:

- A continuous SO_2 monitor be placed in the proposed Ballyclare Air Quality Management Area (see Review and Assessment for PM_{10}).

- The area is re-surveyed, increasing the coverage of the survey to ensure the quantities of coal burnt are representative.

- Further modelling be undertaken, taking account of the secondary data.

PART SIX – REVIEW AND ASSESSMENT OF PARTICLES (PM_{10})

6.1 Introduction

When undertaking this review and assessment the focus has been on the likely exceedances of the objective for PM_{10} at those outdoor locations where the public is likely to be regularly present and is likely to be exposed over the averaging period of the objective.

The Air Quality Objective for PM_{10} is measured as an annual mean and a 24 hour mean and the locations to be considered include building facades of residential properties, schools, hospitals, libraries etc. and gardens of residential properties.

The Government and Devolved Administrations have adopted a maximum annual mean concentration of 40 μgm^{-3} and a 24 hour mean concentration of 50 μgm^{-3} to be exceeded on no more than 35 days per year. Both objectives are to be met by the end of 2004 and are equivalent to the EU Stage I limit values in the first Air Quality Daughter Directive.

The EU has also set further Stage 2 limit values for PM_{10} to be achieved by 1 January 2010. The annual mean limit value has been reduced to 20 μgm^{-3}, the 24 hour mean of 50 μgm^{-3} remains but is not to be exceeded on more than 7 days per year.

These values have been introduced as provisional objectives to be achieved by the end of 2010 by the Government, the Welsh Assembly Government and the Department of the Environment in Northern Ireland but it is not intended that these objectives will be brought into Regulation for the purpose of Local Air Quality Management at this time.

6.2 Sources of Particles

A wide range of emission sources contribute to PM_{10} concentrations in the UK. These sources can be divided into 3 main categories:-

Primary particle emissions derived directly from combustion sources including road traffic, power generation, industrial processes.

Secondary particles formed by chemical reactions in the atmosphere and comprise principally of sulphates and nitrates.

Coarse particles from a wide range of sources including resuspended dusts from road traffic, construction works, mineral extraction processes, wind-blown dusts and soils, sea salt and biological particles.

The following table shows the approximate contributions of various sources to PM_{10} concentrations in the UK in 2002.

Type of particle	Location	Source	Main Source types	Typical contribution to annual mean conc. (ugm^{-3})
Coarse 2.5 – 10mm	Immediate Local	Traffic	Dusts from tyre wear	1 – 6
		Industry	Fugitive dusts Stockpiles Quarries Construction	Variable up to 5
	Urban background	Traffic	Dusts from tyre wear	1 - 2
		Industry	Fugitive dusts Stockpiles Quarries Construction	Variable up to 2
	Regional	Natural	Dust/Soil Sea Salt Biological	2 - 3 1 – 2 1
Fine < 2.5mm	Immediate Local	Traffic	Vehicle Exhaust	1 - 4
		Industry	Combustion Industrial Sources	Variable
		Domestic	Coal Combustion	Variable
	Urban Background	Traffic	Vehicle Exhaust	1 - 4
		Industry	Combustion Industrial Processes	Variable up to 8
		Domestic	Coal Combustion	Variable up to 8
	Regional	Secondary	Power stations Industrial processes Vehicles	4 - 8
		Primary (imported)	Power stations Vehicles Industrial processes	1 - 2
		Natural	Sea salt	< 1

In the review and assessment process it is important to focus on control of emissions at local level. Emissions from road transport will be governed by new legislation on vehicle emission standards, and emissions of secondary particles will largely be governed by controls on power generation, industrial and transport SO_2 and NO_x emissions. However emissions of coarse particles are largely uncontrolled and are not expected to decline in future years.

The focus of this review and assessment will therefore be on the management of particle emissions from local sources.

6.3 First Stage Review and Assessment

6.3.1 Roads and Junctions

Roads and junctions were identified at first stage in line with Technical Guidance LAQM TG 4/(00).

Two nomograms for a single carriageway road and a dual carriageway road on a motorway as per the guidance were used to determine the relationship between daily mean traffic flow, average traffic speed and 2004 background PM_{10} concentrations and the risk of exceeding the objective for PM_{10}.

Using this method

- at least one section of a single carriageway road,
- one dual carriageway and at least 21 junctions

were predicted to exceed the projected annual average daily traffic flow thresholds.

6.3.2 Planned Developments

Six planned developments within the Newtownabbey area were also identified with the potential to increase traffic flows by 2004.

6.3.3 Domestic Sources

Three 1 x 1 km squares within Newtownabbey Borough Council were identified at First Stage to have potentially more than 850 households burning solid fuel (as per Technical Guidance LAQM.TG (00)) and there was a risk of the 2004 objective for PM_{10} being exceeded for residential coal burning (see **Table 1, Appendix 4**). The three squares identified were Ballyclare, Carnmoney and Mossley.

6.3.4 Industrial Sources

Two significant Part B processes within the Borough were identified together with two Part A processes in neighbouring Carrickfergus Borough Council area and Belfast City Council area:

James Boyd & Sons (Carnmoney) Ltd, Newtownabbey;
Home Fuels Ltd, Mallusk Park, Newtownabbey;
AES Kilroot Power Station, Carrickfergus;
Belfast Sewage Sludge Incinerator, Belfast.

6.3.5 Monitoring of PM_{10}

Prior to the First Stage Review and Assessment two non-automatic 8-port bubblers were used to monitor black smoke in the Borough.

6.4 Second Stage Review and Assessment

6.4.1 Roads and Junctions

The annual mean PM_{10} concentration for 2004 at 42 kerbside locations in the Borough was estimated by Netcen using the Design Manual for Road Bridges (DMRB) 1999 (Air Quality Review and Assessment Stage 2, May 2002, Netcen).

Technical Guidance LAQM.TG (03) indicates that the Design Manual for Roads and Bridges (DMRB) Screening Model can be used as a screening assessment for road traffic sources.

The background concentrations given within the model were ignored. An estimated maximum background concentration of 22.5 μgm^{-3} for the Newtownabbey Borough Council area was added to provide total predicated PM_{10}

concentrations. Estimated traffic flows for 2005 as calculated by the Council were used in the model (expected traffic flows in 2004 were not available).

The predicted 2004 PM_{10} concentrations at roadside locations in the Newtownabbey Borough Council area are shown below.

Description of Link	**PM_{10} Annual Mean (μgm^{-3}) 2004**
Shore Road, south of Jordanstown Road	23.36
Mallusk Road, west of Scullions Road	22.90
Doagh Road at Kings Road	23.14
Church Road	22.13
Station Road at Old Station Road	21.66
Longwood Road, house at corner of 2 roads	26.89
Old Carrick Road, east of Monkstown Road	22.14
Newtownabbey Road, northwest of Sandyholme Park	22.06
Ballyclare Road, south of Manse Road, Glengormley	21.33
Upper Market Square	22.28
South of Sandyknowes	22.45
Station Road, Shore Road (M5) Shore Road (Jordanstown)	21.67
Sandyknowes junction (Link to A8(M) and Ballyhenry Road	22.56
Sandyknowes junction (Link to M2 and Newtownabbey Road)	21.41
Shore Road/Jordanstown Road junction	24.22
O'Neill Road/Doagh Road junction	23.15
M5 junction (M5 and Shore Road)	21.33
A8 Mossley junction	24.38
Ballyclare Road/Newtownabbey Road/Hightown Road junction	22.03
A8 Ballyclare Road junction	21.18
Mallusk Road/Bernice Road junction	24.98
Monkstown Road/Doagh Road junction	24.21

Description of Link	PM_{10} Annual Mean (μgm^{-3}) 2004
Ballynure Road/Templepatrick Road junction	23.17
Manse Road/Prince Charles Way junction	22.59
Ballyclare Road/Ballyhenry Road junction	22.48
Hillhead Road/Ballynure Road junction	21.37
Doagh Road/Carnmoney Road North junction	21.14
Shore Road/Longwood Road junction	25.40
Carnmoney Road North/Manse Road junction	21.07
Ballyrobert Road/Templepatrick Road junction	22.62
The Longshot/Templepatrick Road junction	21.82
Monkstown Road/Old Carrick Road junction	23.52
Templepatrick Road/Mill Road junction	21.31
Ballynure Road/B58 junction	23.07
Prince Charles Way/Ashgrove Road/Burnthill Road junction	21.38
Manse Road/Doagh Road junction	21.40
Monkstown Road/Jordanstown Road junction	21.22
Templepatrick Road/Station Road junction	23.71
Hightown Road/Mallusk Road junction	24.69
Doagh Road/North End/Market Square junction	22.07
Main Street/Mill Road/Mill Road junction	22.46
Hillhead Road/Mill Road/Mill Road junction	22.13
Doagh – Main St/Doagh Road/Ballymena Road/Burn Road junction	20.89

At the time of the assessment, Technical Guidance LAQM TG4 (00) stated the 24 hour objective for PM_{10} was highly unlikely to be exceeded if the annual mean concentration was below 28 μgm^{-3}.

Based on this Guidance the DMRB model predicted annual average concentrations of PM_{10} less than 28 ugm^{-3} at all the locations modelled.

It is therefore not necessary to proceed to the third stage of the Review and Assessment Process for PM_{10} from road traffic sources.

6.4.2 Domestic Sources

Fuel use surveys were carried out in ten 1x1 Km squares within the Borough between February 2002 and November 2003. See Section 5.4.1 for findings.

6.4.3 Industrial Sources

An assessment of the impact on PM_{10} concentrations in the Newtownabbey Borough Council area of the following industrial processes was also completed by Netcen (Air Quality Review and Assessment Stage 2, May 2002, Netcen).

a) *James Boyd & Sons (Carnmoney) Ltd*

This is a Part B process located at 140 Mallusk Road, Newtownabbey. It is a quarry which extracts 500,000 tonnes of stone (basalt) a year which is then processed to aggregate. The majority of dust emissions from quarrying tend to be within the larger particle size fractions and correspondingly fall out from the atmosphere rapidly with increasing distance from the source.

The nearest property to James Boyd & Sons is approximately 34 metres. Where properties lie closer than 200m to the source, the GB Pollutant Specific Guidance LAQM TG 4(00) suggests that authorities investigate whether any dust nuisance complaints have been received. At the time of the assessment by Netcen, no dust nuisance complaints had been received.

In October 2003, three complaints from residents were received by Newtownabbey Borough Council regarding dust from quarry blasting at James Boyd & Sons. None of these complaints, however, has been substantiated and it is therefore not necessary to proceed to the third

stage review and assessment for PM_{10} from James Boyd & Sons (Carnmoney) Ltd.

b) *Home Fuels Ltd*

This is a Part B process located at Mallusk Park, Newtownabbey. The process is authorised under the Industrial Pollution Control regime by Newtownabbey Borough Council. The IPC authorisation states it is Home Fuel's policy not to store more than 25 tonnes of loose slack at any time.

There is the potential, however, for dust emissions within the PM_{10} size fraction to arise from material stockyards. The nearest property to Home Fuels Ltd is 106 metres. Where properties lie closer than 200 metres to the source, GB Pollutant Specific Guidance LAQM TG 4(00) suggests that authorities investigate whether any dust nuisance complaints have been received. No such complaints have ever been received from activities arising at the stockyard and this, together with visual inspections carried out for IPC purposes, suggests there is no need to progress to a third stage review and assessment for PM_{10} from Home Fuels Ltd.

c) *AES Kilroot Power Station*

This oil fired power station is a Part A process in neighbouring Carrickfergus Borough Council's area.

Specification of combustion processes at Kilroot Power Station

	Kilroot Power Station
Temperature of emissions ^0C	120
Stack Height (m)	200
Stack Diameter (m)	8
PM_{10} tonnes per annum	226

The height of the tallest building within 5 stack heights is 57m. Using the nomogram provided in the Pollutant Specific Guidance LAQM.TG4 (00)

(figure 8.5) gives the annual PM_{10} emission which will give rise to a 90^{th} percentile of the 24 hour ground level concentration of 1 μgm^{-3}.

Using the nomogram, the permitted PM_{10} emission rate with an industry of the above dimensions is 1800 tonnes per annum. This is well above the actual emission at Kilroot of 226 tonnes per annum and it is therefore not necessary to proceed to the third stage of the review and assessment process for PM_{10} from AES Kilroot Power Station.

d) *Belfast Sewage Sludge Incinerator*

This is a Part A process in neighbouring Belfast City Council's area.

Specifications of the combustion processes at the Belfast Sewage Sludge Incinerator

	Sewage Sludge Incinerator
Temperature of emission (^0C)	120
Stack Height (m)	70
Stack Diameter (m)	0.9
PM_{10} tonnes per annum	< 0.1

Using the nomogram provided in the Pollutant Specific Guidance LAQM TG4(00) (Figure 8.5)) gives the annual PM_{10} emission which will give rise to a 90^{th} percentile of the 24 hour ground level concentration of 1 $\mu gm^{-3.}$

Using this nomogram the permitted PM_{10} emission rate with an industry of the above dimensions is 23 tonnes per annum. This is well above the actual emission of < 0.1 tonnes per annum at the incinerator and it is therefore not necessary to proceed to the third stage of the review and assessment process for PM_{10} from Belfast Sewage Sludge Incinerator.

6.4.4 PM_{10} Monitoring

Following the First Stage Review and Assessment (March 2002) the 8 port bubblers were resited at The Glade, Mossley and Mossvale Park, Ballyclare. See Section 5.4.2.1.

Location	Grid Reference	Operating From
The Glade, Mossley (Newtownabbey 3)	321 851	13.12.01
Mossvale Park, Ballyclare (Newtownabbey 4)	283 907	12.2.02

The non-automatic 8-port bubblers measure both sulphur dioxide and fine suspended particulate (as black smoke) over 24 hour periods. The sampler draws ambient air, at a controlled and metered rate, first through a filter paper on which suspended particulate is collected then through a solution in which sulphur dioxide is absorbed.

The exposed filter papers, when removed from the sampler, exhibit a dark circular smoke stain. The darkness of the satin is measured using a smoke stain reflectometer which emits light onto the stain and measures the reflectance. The darker the stain, the less light is reflected. This measurement is used to calculate the ambient concentration of black smoke.

All data from the 8 port samplers is subject to both quality assurance and control by AEA Technology (Netcen). Technical Guidance LAQM.TG (03) does not recommend the use of 8 port bubblers to measure PM_{10} due to the uncertainty in the relationship between black smoke data collected by the bubblers and $PM_{10.}$ Black smoke data may however be useful for indicating local 'hot spots' and assist with the siting of PM_{10} samplers.

The black smoke results for 2003 are shown in **Table 2, Appendix 4**.

The annual average black smoke data for the two monitoring sites in 2003 are listed below:

Location	Annual Average μgm^{-3}
Newtownabbey 3	9
Newtownabbey 4	8.25

6.5 Third Stage Review and Assessment

6.5.1 Domestic Sources

Following the fuel use surveys, four of the 1 x 1 km squares which were predicted to have more than 300 coal-burning properties within the square were modelled by Netcen (Air Quality Review and Assessment Stage 3 – Domestic Fuel Combustion May 2004 – Appendix 3).

The modelling predicted that under certain meteorological conditions conducive to poor dispersion there would be an exceedance of the daily mean PM_{10} objective in 2004 in the Ballyclare area due to emissions from domestic fuel combustion.

On the basis that an exceedance is likely under specific meteorological conditions an Air Quality Management Area (AQMA) should be declared and a further assessment undertaken. Domestic fuel combustion is believed to be the only significant source in the localised area and is the only source modelled. Therefore for source apportionment it is reasonable to conclude that domestic fuel combustion is the cause of the predicted PM_{10} exceedance, composing the background contribution and the domestic fuel combustion contribution.

The reduction in concentration required to meet the Air Quality Objective for PM_{10} is a reduction of 6-7 μgm^{-3}.

6.6 Conclusion

It will not be necessary to declare an Air Quality Management Area in Newtownabbey for PM_{10} from road traffic or industrial sources. However, based on Netcen's recommendation and subject to DEFRA review it is necessary for Newtownabbey Borough Council to declare an Air Quality Management Area for PM_{10} from domestic sources in Ballyclare.

Ballyclare Proposed Air Quality Management Area

The boundary of the AQMA will be based approximately on the 45 µg contour produced from the dispersion modelling. The boundary will be modified slightly to take into account geographical features such as roads, buildings etc.

Newtownabbey Borough Council, in making the decision to declare the AQMA, has adopted a precautionary approach in the interests of public health as the recommendation to declare is based only upon predicted exceedances from the dispersion modelling and has not been corroborated by local monitoring.

It may be the case with further modelling, local monitoring and updated fuel use information that the AQMA may be revoked.

6.7 Recommendation

It is recommended that an Air Quality Management Area be declared for PM_{10} from domestic sources in the Ballyclare area and in order to validate the findings of the model it is recommended that:

- A continuous PM_{10} monitor together with QA and QC procedures is set up within the AQMA.

- The area is re-surveyed, increasing the coverage of the survey to ensure the quantities of coal burnt are representative.

- Further modelling of possible fuel use change scenarios is carried out to provide information on the quantity of emissions reduction that the scenarios could deliver. From this the subsequent change in concentration could be modelled within the exceedance area. This further modelling would therefore provide the information required to inform what options are available to reduce concentration for the action planning phase and how effective they would be for working towards the objective.

- Consultation takes place with Northern Ireland Housing Executive regarding any plans to convert properties from coal burning to oil.

APPENDIX 1

Table 1

Location of NO_2 Diffusion Tubes Prior to First Stage Review and Assessment

Site No.	Location	Date Monitoring Commenced	Grid Reference
212	229 Jordanstown Road	July 1999	
216	Newton Gardens	July 1999	
218	202 Carnmoney Road	July 1999	
219	Lenamore Park	July 1999	
1R 1N	Main Street, Ballyclare	July 1999	289 911

Table 4

Location of NO_2 Diffusion Tubes Commencing December 2001

Site No.	Location	Date Monitoring Commenced	Grid Reference
2	Burnthill Road	December 2001	315 831
3	St Bernards School, Antrim Road	December 2001	323 819
4	Prince Charles Way	December 2001	
6	Greenacres, Glebe Road	December 2001	324 832
7	Valley Leisure Centre	December 2001	336 814
8	74 Shore Road	December 2001	
9	Merville Garden Village	December 2001	348 807
10	M5 at Shore Road	December 2001	354 815
11	44 Sandyknowes Avenue	December 2001	306 827
12	Tudor Park, Mallusk	December 2001	298 834
13	Scullions Road, Mallusk	December 2001	304 829
14	Bottom Main Street, Ballyclare	December 2001	291 909
15	North End, Ballyclare	December 2001	287 913
16	Doagh Village	December 2001	262 895
17	The Longshot, Doagh	December 2001	268 885
18	Main Street, Ballynure	December 2001	319 936
19	A8/Doagh Road	December 2001	310 859
20R 11N	A8/Motorway at Sandyknowes	December 2001	305 832
21	Ballyclare Road/Manse Road	December 2001	314 838
22	Manse Road/Doagh Road	December 2001	
23	Opposite 189 Doagh Road	December 2001	344 829
24	O'Neill Road/Doagh Road	December 2001	355 823
25	Station Road	December 2001	355 824
26R 12N	690 Shore Road	December 2001	367 837
27	Opposite 1A Jordanstown Road	December 2001	365 836
28	Jordanstown Road	December 2001	352 844
29	174 Monkstown Road	December 2001	343 852

Table 5

Location of NO_2 Diffusion Tubes Commencing April 2002

Site No.	Location	Date Monitoring Commenced	Grid Reference
4	Hightown/Mallusk Road junction	April 2002	314 821
8 B13N	Braden Heights, Rathcoole	April 2002	339 819
22	Nortel	April 2002	342 838
30	Hillhead Road/Mill Road roundabout	April 2002	291 909
31	Bernice Road/Mallusk Road	April 2002	277 835
32	Antrim Road (Sandyknowes)	April 2002	306 829
33	Manse Road/Prince Charles Way r'bout	April 2002	314 838
34	Old Carrick Road/Oaklands	April 2002	344 852
35	Henryville Court, Ballyclare	April 2002	296 910

Table 6

Estimation of Annual Mean Nitrogen Dioxide Conc. From Short-Term Monitoring Data as Per Box 6.5 Page 6.8 Technical Guidance TG (03)

Comparison of Newtownabbey Borough Council Site 11 NO_2 Diffusion Tube Results (2003) to Belfast Central AURN Site

Diffusion Tube Monitoring Period 2003	**Belfast City Council Annual Mean (Am) (2003)**	**Belfast City Council Period Mean (PM) (2003)**	**Ratio (AM Divided by PM)**
February	32	38	
March	32	42	
April	32	31	
May	32	25	
September	32	34	
November	32	38	
December	32	42	
Average (7 months)	**32**	**35.7**	**0.9**

Site 11 – average based on 7 months diffusion tube monitoring = 38

Annual mean = 38.0 x 0.9 **= 34.2 μgm^{-3}**

Table 6 (cont'd)

Estimation of Annual Mean Nitrogen Dioxide Conc. From Short-Term Monitoring Data as Per Box 6.5 Page 6.8 Technical Guidance TG (03)

Comparison of NBC Site 21 NO_2 Diffusion Tube Results (2003) to Belfast Central AURN Site

Diffusion Tube Monitoring Period 2003	**Belfast City Council Annual Mean (Am) (2003)**	**Belfast City Council Period Mean (PM) (2003)**	**Ratio (AM Divided by PM)**
January	32	36	
February	32	38	
March	32	42	
April	32	31	
May	32	25	
July	32	19	
August	32	29	
September	32	34	
October	32	31	
Average (9 months)	**32**	**31.667**	**1.01**

Site 21 – average based on 9 months diffusion tube monitoring = 33

Annual mean = 33.0 x 1.01 **= 33.3 μgm^{-3}**

APPENDIX 2

Table 2

Location of SO_2 Diffusion Tubes Commencing December 2001

Site No.	Location	Date Monitoring Commenced	Grid Reference
1	22 Osterley Park	December 2001	324 825
2	Burnside	December 2001	236 918
3	Glenbroome Park	December 2001	361 835
4	Mountpleasant	December 2001	353 845
5	Waverley Road	December 2001	322 842
6	Burnthill Crescent	December 2001	317 834
7	Carwood Avenue	December 2001	313 835
8	Mountainvale Park	December 2001	313 823
9	Ravelston Avenue	December 2001	328 841
10	Anderson Park, Doagh	December 2001	263 895
11	24 Braden Heights	April 2003	339 819

APPENDIX 3

APPENDIX 4

Number of Houses Burning Coal within 1 x 1 km grid squares

1 x 1 km Grid No.	*Area Covered*	*Total Number of Houses*			*Coal Burning*		
		NI Housing Executive	*Other*	*Total*	*NI Housing Executive*	*Other*	*Total*
1	**Ballyclare**	403	947	1350	183	237	420
2	**Carnmoney**	100	1854	1954	54	464	518
3	**Mossley**	756	566	1322	380	142	522
4	**Rathcoole**	1668	362	2030	758	91	849

REFERENCES

Belfast City Council (April 2004), Second and Third Stages of the National Air Quality Review and Assessment Process

DRD Roads Service (February 2003), Air Quality Assessment Traffic Data Collection

Netcen (April 2003), Revised DMRB Assessment